



SEQUENCE LISTING

<110> Forschungszentrum Juelich GmbH; Marina Vrlijc et al.

<120> Process for the microbial production of amino acids by  
boosted activity of export carriers

II  
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<140> US/09/105,117

<141> 1998-06-17

<150> PCT/DE96/02485

<151> 1996-12-18

<160> 5

<170> PatentIn Ver. 2.0

<210> 1

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<212> DNA

<213> Corynebacterium glutamicum

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<221> gene

<222> CDS (1016)..(1726)

<223> (LysE)

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 gcc gcg ccg atc gtg ctc gat att atg cgc tgg ggt gcc atc gct tac 1258  
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 Val Glu Ala Pro Gln Ile Ile Glu Glu Thr Glu Pro Thr Val Pro Asp  
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 gtg cgg gtg gag gtg agc gtc gat aag cag cgg gtt tgg gta aag ccc 1450  
 Val Arg Val Glu Val Ser Val Asp Lys Gln Arg Val Trp Val Lys Pro  
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 Asp Ala Phe Val Phe Ile Gly Gly Val Gly Ala Gln Tyr Gly Asp Thr  
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gga cgg tgg att ttc gcc gct ggc gcg ttc gcg gca agc ctg atc tgg 1594  
 Gly Arg Trp Ile Phe Ala Ala Gly Ala Phe Ala Ala Ser Leu Ile Trp  
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 Phe Pro Leu Val Gly Phe Gly Ala Ala Ala Leu Ser Arg Pro Leu Ser  
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agc ccc aag gtg tgg cgc tgg atc aac gtc gtc gtg gca gtt gtg atg 1690  
 Ser Pro Lys Val Trp Arg Trp Ile Asn Val Val Val Ala Val Val Met  
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acc gca ttg gcc atc aaa ctg atg ttg atg ggt tag ttttcgcggg 1736  
 Thr Ala Leu Ala Ile Lys Leu Met Leu Met Gly  
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<213> Corynebacterium glutamicum

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Ile Lys Arg Glu Gly Leu Ile Ala Val Leu Leu Val Cys Leu Ile Ser  
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Asp Val Phe Leu Phe Ile Ala Gly Thr Leu Gly Val Asp Leu Leu Ser  
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Asn Ala Ala Pro Ile Val Leu Asp Ile Met Arg Trp Gly Gly Ile Ala  
65 70 75 80

Tyr Leu Leu Trp Phe Ala Val Met Ala Ala Lys Asp Ala Met Thr Asn  
85 90 95

Lys Val Glu Ala Pro Gln Ile Ile Glu Glu Thr Glu Pro Thr Val Pro  
100 105 110

Asp Asp Thr Pro Leu Gly Gly Ser Ala Val Ala Thr Asp Thr Arg Asn  
115 120 125

Arg Val Arg Val Glu Val Ser Val Asp Lys Gln Arg Val Trp Val Lys  
130 135 140

Pro Met Leu Met Ala Ile Val Leu Thr Trp Leu Asn Pro Asn Ala Tyr  
145 150 155 160

Leu Asp Ala Phe Val Phe Ile Gly Gly Val Gly Ala Gln Tyr Gly Asp  
165 170 175

Thr Gly Arg Trp Ile Phe Ala Ala Gly Ala Phe Ala Ala Ser Leu Ile  
180 185 190

Trp Phe Pro Leu Val Gly Phe Gly Ala Ala Ala Leu Ser Arg Pro Leu  
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 tct gga aag gct ctt tac gtg ggt att tct tcc tac ggt cca gag ctc 97  
 Ser Gly Lys Ala Leu Tyr Val Gly Ile Ser Ser Tyr Gly Pro Glu Leu  
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 aca gcg gag gcg gct gag ttc atg gcg gag gag ggc tgc ccg ctt ctg 145  
 Thr Ala Glu Ala Ala Glu Phe Met Ala Glu Glu Gly Cys Pro Leu Leu  
 35 40 45  
  
 att cat cag cca agc tat tcc atc att aat cgt tgg gtg gag gaa ccg 193  
 Ile His Gln Pro Ser Tyr Ser Ile Ile Asn Arg Trp Val Glu Glu Pro  
 50 55 60  
  
 ggc gat gac ggt gag aac ttg ttg cag tca gct gcc aac aat ggt ctt 241  
 Gly Asp Asp Gly Glu Asn Leu Leu Gln Ser Ala Ala Asn Asn Gly Leu  
 65 70 75 80  
  
 ggc gtc att gct ttc tca cca ctt gcg cag ggc ctg ctc acg gac aaa 289  
 Gly Val Ile Ala Phe Ser Pro Leu Ala Gln Gly Leu Leu Thr Asp Lys  
 85 90 95  
  
 tat ctc gat gga att cca gag ggt tcc cgc gcc agc cag ggt aag tcc 337  
 Tyr Leu Asp Gly Ile Pro Glu Gly Ser Arg Ala Ser Gln Gly Lys Ser  
 100 105 110  
  
 ctg tct gag ggc atg ttg aac gtg aac aat att gat atg gtc cgc aag 385  
 Leu Ser Glu Gly Met Leu Asn Val Asn Asn Ile Asp Met Val Arg Lys  
 115 120 125  
  
 ctc aat gac atc gcc cag gaa cgc ggg cag tca ctt gcg cag atg gcg 433  
 Leu Asn Asp Ile Ala Gln Glu Arg Gly Gln Ser Leu Ala Gln Met Ala  
 130 135 140  
  
 ctt gca tgg gtg ctg cgc gag caa gga gag tac ggc gcg gat acc gtg 481  
 Leu Ala Trp Val Leu Arg Glu Gln Gly Glu Tyr Gly Ala Asp Thr Val  
 145 150 155 160

acc agt gca ttg att ggt gct tcg tca gtt gag cag ctg gac aac agc 529  
 Thr Ser Ala Leu Ile Gly Ala Ser Ser Val Glu Gln Leu Asp Asn Ser  
                   165                                  170                                  175

ctt gat tca ctc aac aac ttg gag ttt tct gac gcc gag ttg gag gcg 577  
 Leu Asp Ser Leu Asn Asn Leu Glu Phe Ser Asp Ala Glu Leu Glu Ala  
                   180                                  185                                  190

atc gat gag att tcc cac gac gcc ggc atc aac att tgg gcg aag gcc 625  
 Ile Asp Glu Ile Ser His Asp Ala Gly Ile Asn Ile Trp Ala Lys Ala  
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acc gat tcc aaa acc cgc gaa aac taa cccatcaaca tcagtttgat 672  
 Thr Asp Ser Lys Thr Arg Glu Asn  
                   210                                  215

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ggacagcggg cgtgacaatg ctgctgcgcc gaaaccacc agcgggaacc agatcagggt 792

tgccgcgaac gcgccagcgg cgaaaatcca ccgtccggtg tcgccgtatt gcgcgccgac 852

gccgccgata aacacaaacg cgtccaaata cgcattcggg ttcaaccagg tcagcacgat 912

tgccatcaac atgggcttta cccaaaccgg ctgcttatcg acgctcacct ccaccgcac 972

ccggttgccg gtgtcagtgg ccaccgccga accgccccaa ggcgtgtcat cgggcacggg 1032

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gatcggcgcg gcattggaca aaagatcaac gcccaagggt ccggcgatga aaaaaagac 1212

gtcagaaatt aaacacacga gaagaaccgc aatgagtcct tcgcgcttaa ttccttggtt 1272

aatcaccagt acattctgcg gtccgatgga cagtaaaaga ctggccccca aaagcagacc 1332

tgtaatgaag atttccatga tcaccatcgt gacctatgga agtacttaag taaaatgatt 1392

ggttcttaac atggtttaat atagcttc atg aac ccc att caa ctg gac act 1444  
   Met Asn Pro Ile Gln Leu Asp Thr  
   220                                  225

ttg ctc tca atc att gat gaa ggc agc ttc gaa ggc gcc tcc tta gcc 1492  
 Leu Leu Ser Ile Ile Asp Glu Gly Ser Phe Glu Gly Ala Ser Leu Ala  
                   230                                  235                                  240

ctt tcc att tcc ccc tcg gcg gtg agt cag cgc gtt aaa gct ctc gag 1540  
 Leu Ser Ile Ser Pro Ser Ala Val Ser Gln Arg Val Lys Ala Leu Glu  
                   245                                  250                                  255

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| cat | cac | gtg | ggt | cga | gtg | ttg | gta | tcg | cgc | acc | caa | ccg | gcc | aaa | gca | 1588 |
| His | His | Val | Gly | Arg | Val | Leu | Val | Ser | Arg | Thr | Gln | Pro | Ala | Lys | Ala |      |
|     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |     |      |
| acc | gaa | gcg | ggt | gaa | gtc | ctt | gtg | caa | gca | gcg | cgg | aaa | atg | gtg | ttg | 1636 |
| Thr | Glu | Ala | Gly | Glu | Val | Leu | Val | Gln | Ala | Ala | Arg | Lys | Met | Val | Leu |      |
|     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |     |      |
| ctg | caa | gca | gaa | act | aaa | gcg | caa | cta | tct | gga | cgc | ctt | gct | gaa | atc | 1684 |
| Leu | Gln | Ala | Glu | Thr | Lys | Ala | Gln | Leu | Ser | Gly | Arg | Leu | Ala | Glu | Ile |      |
| 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     | 305 |      |
| ccg | tta | acc | atc | gcc | atc | aac | gca | gat | tcg | cta | tcc | aca | tgg | ttt | cct | 1732 |
| Pro | Leu | Thr | Ile | Ala | Ile | Asn | Ala | Asp | Ser | Leu | Ser | Thr | Trp | Phe | Pro |      |
|     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |     |      |
| ccc | gtg | ttc | aac | gag | gta | gct | tct | tgg | ggt | gga | gca | acg | ctc | acg | ctg | 1780 |
| Pro | Val | Phe | Asn | Glu | Val | Ala | Ser | Trp | Gly | Gly | Ala | Thr | Leu | Thr | Leu |      |
|     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |     |      |
| cgc | ttg | gaa | gat | gaa | gcg | cac | aca | tta | tcc | ttg | ctg | cgg | cgt | gga | gat | 1828 |
| Arg | Leu | Glu | Asp | Glu | Ala | His | Thr | Leu | Ser | Leu | Leu | Arg | Arg | Gly | Asp |      |
|     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |     |      |
| gtt | tta | gga | gcg | gta | acc | cgt | gaa | gct | aat | ccc | gtg | gcg | gga | tgt | gaa | 1876 |
| Val | Leu | Gly | Ala | Val | Thr | Arg | Glu | Ala | Asn | Pro | Val | Ala | Gly | Cys | Glu |      |
|     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |     |      |
| gta | gta | gaa | ctt | gga | acc | atg | cgc | cac | ttg | gcc | att | gca | acc | ccc | tca | 1924 |
| Val | Val | Glu | Leu | Gly | Thr | Met | Arg | His | Leu | Ala | Ile | Ala | Thr | Pro | Ser |      |
| 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     | 385 |      |
| ttg | cgg | gat | gcc | tac | atg | gtt | gat | ggg | aaa | cta | gat | tgg | gct | gcg | atg | 1972 |
| Leu | Arg | Asp | Ala | Tyr | Met | Val | Asp | Gly | Lys | Leu | Asp | Trp | Ala | Ala | Met |      |
|     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |     |      |
| ccc | gtc | tta | cgc | ttc | ggt | ccc | aaa | gat | gtg | ctt | caa | gac | cgt | gac | ctg | 2020 |
| Pro | Val | Leu | Arg | Phe | Gly | Pro | Lys | Asp | Val | Leu | Gln | Asp | Arg | Asp | Leu |      |
|     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |     |      |
| gac | ggg | cgc | gtc | gat | ggt | cct | gtg | ggg | cgc | agg | cgc | gta | tcc | att | gtc | 2068 |
| Asp | Gly | Arg | Val | Asp | Gly | Pro | Val | Gly | Arg | Arg | Arg | Val | Ser | Ile | Val |      |
|     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |     |      |
| ccg | tcg | gcg | gaa | ggt | ttt | ggt | gag | gca | att | cgc | cga | ggc | ctt | ggt | tgg | 2116 |
| Pro | Ser | Ala | Glu | Gly | Phe | Gly | Glu | Ala | Ile | Arg | Arg | Gly | Leu | Gly | Trp |      |
|     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |     |      |
| gga | ctt | ctt | ccc | gaa | acc | caa | gct | gct | ccc | atg | cta | aaa | gca | gga | gaa | 2164 |
| Gly | Leu | Leu | Pro | Glu | Thr | Gln | Ala | Ala | Pro | Met | Leu | Lys | Ala | Gly | Glu |      |
| 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     | 465 |      |

11  
Conf.

gtg atc ctc ctc gat gag ata ccc att gac aca ccg atg tat tgg caa 2212  
 Val Ile Leu Leu Asp Glu Ile Pro Ile Asp Thr Pro Met Tyr Trp Gln  
                   470                  475                  480

cga tgg cgc ctg gaa tct aga tct cta gct aga ctc aca gac gcc gtc 2260  
 Arg Trp Arg Leu Glu Ser Arg Ser Leu Ala Arg Leu Thr Asp Ala Val  
                   485                  490                  495

gtt gat gca gca atc gag gga ttg cgg cct tag ttacttctga aaaggttcag 2313  
 Val Asp Ala Ala Ile Glu Gly Leu Arg Pro  
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                   20                  25                  30

Thr Ala Glu Ala Ala Glu Phe Met Ala Glu Glu Gly Cys Pro Leu Leu  
                   35                  40                  45

Ile His Gln Pro Ser Tyr Ser Ile Ile Asn Arg Trp Val Glu Glu Pro  
                   50                  55                  60

Gly Asp Asp Gly Glu Asn Leu Leu Gln Ser Ala Ala Asn Asn Gly Leu  
   65                  70                  75                  80

Gly Val Ile Ala Phe Ser Pro Leu Ala Gln Gly Leu Leu Thr Asp Lys  
                   85                  90                  95

Tyr Leu Asp Gly Ile Pro Glu Gly Ser Arg Ala Ser Gln Gly Lys Ser  
                   100                  105                  110

Leu Ser Glu Gly Met Leu Asn Val Asn Asn Ile Asp Met Val Arg Lys  
                   115                  120                  125

Leu Asn Asp Ile Ala Gln Glu Arg Gly Gln Ser Leu Ala Gln Met Ala  
                   130                  135                  140



Leu Ala Trp Val Leu Arg Glu Gln Gly Glu Tyr Gly Ala Asp Thr Val  
 145 150 155 160

Thr Ser Ala Leu Ile Gly Ala Ser Ser Val Glu Gln Leu Asp Asn Ser  
 165 170 175

Leu Asp Ser Leu Asn Asn Leu Glu Phe Ser Asp Ala Glu Leu Glu Ala  
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Thr Asp Ser Lys Thr Arg Glu Asn  
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Ser Gln Arg Val Lys Ala Leu Glu His His Val Gly Arg Val Leu Val  
 35 40 45

Ser Arg Thr Gln Pro Ala Lys Ala Thr Glu Ala Gly Glu Val Leu Val  
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Gln Ala Ala Arg Lys Met Val Leu Leu Gln Ala Glu Thr Lys Ala Gln  
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Leu Ser Gly Arg Leu Ala Glu Ile Pro Leu Thr Ile Ala Ile Asn Ala  
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Asp Ser Leu Ser Thr Trp Phe Pro Pro Val Phe Asn Glu Val Ala Ser  
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Trp Gly Gly Ala Thr Leu Thr Leu Arg Leu Glu Asp Glu Ala His Thr  
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Leu Ser Leu Leu Arg Arg Gly Asp Val Leu Gly Ala Val Thr Arg Glu  
 130 135 140

Ala Asn Pro Val Ala Gly Cys Glu Val Val Glu Leu Gly Thr Met Arg  
145 150 155 160

His Leu Ala Ile Ala Thr Pro Ser Leu Arg Asp Ala Tyr Met Val Asp  
165 170 175

Gly Lys Leu Asp Trp Ala Ala Met Pro Val Leu Arg Phe Gly Pro Lys  
180 185 190

Asp Val Leu Gln Asp Arg Asp Leu Asp Gly Arg Val Asp Gly Pro Val  
195 200 205

Gly Arg Arg Arg Val Ser Ile Val Pro Ser Ala Glu Gly Phe Gly Glu  
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Ala Ile Arg Arg Gly Leu Gly Trp Gly Leu Leu Pro Glu Thr Gln Ala  
225 230 235 240

Ala Pro Met Leu Lys Ala Gly Glu Val Ile Leu Leu Asp Glu Ile Pro  
245 250 255

Ile Asp Thr Pro Met Tyr Trp Gln Arg Trp Arg Leu Glu Ser Arg Ser  
260 265 270

Leu Ala Arg Leu Thr Asp Ala Val Val Asp Ala Ala Ile Glu Gly Leu  
275 280 285

Arg Pro  
290